# CRITICISM, ALTERNATIVES AND TESTS: A CONCEPTUAL FRAMEWORK FOR IMPROVING TYPOGRAPHY

By

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# *Criticism, Alternatives and Tests: A Conceptual Framework for Improving Typography*

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**Abstract:** The purpose of legibility research is not to discover universal truths, but to improve the *practice* of typography and design. Research should be directed to specific decisions in particular, practical situations. This article suggests a practical research style which makes use of the tacit know-how of typographers and designers. The idea is to preface any testing activities with critical and creative activities. This leads to a three-part cyclical model: criticism, alternatives and tests. Such a model starts with a practical problem and finishes with a decision. This model is illustrated by a critical analysis of some Open University texts.

## Introduction

One contribution which academics make to the practice of typography is to conduct experiments and report the results in journals. The record of such research stretches back well over a hundred years, yet it is fair to say that the results are rather disappointing. Few practical problems can be resolved by this research and, consequently, most designers and typographers go about their work without consulting the research literature at all.

In this article we suggest that researchers in legibility have had an excessively narrow view of the nature of scientific research. We are led to propose a conceptual framework which could unite typographers and researchers to the advantage of both. This framework might well apply to other situations where research (mysteriously) never seems to be relevant to the concerns at hand.

## The classical research literature

The research into typography has been reviewed many times; the most influential commentators have been Pyke (1926), Paterson and Tinker (1940), Luckiesh and Moss (1942), Burt (1959) and Tinker (1963). As we reviewed this work we began to see certain systematic defects in the research, defects which we have tried to document and explain.

In the first place there are experiments whose relevance to day-to-day problems cannot easily be seen. For example, there are many tests of the relative legibility of characters in a fount. Such reports list "letters of low legibility" or "pairs of letters most likely to be confused." Experiments of this kind are amongst the most frequent in the legibility field, and are still being reported in the journals to this day. The authors of such work do not tell us what we should do with such results. No doubt that is proper caution, for it has long been clear that confusion of individual letters is of negligible importance in the reading process (Vernon 1931).

Much more serious are the omissions. Indeed, there is a sense in which legibility research has hardly started—so many important topics have not been tackled. We distinguish various kinds of omission. One kind occurs when previous research is not up-dated. For example, tests done on obsolete type-faces need to be re-done on new type-faces. Or, the effects of new composition systems are not investigated. Another omission occurs when researchers concentrate solely on the Roman alphabet, as they have done with few exceptions. This leaves many important languages without research guidance. By far the most important kind of omission occurs when researchers overlook the advent of completely new problems. For example, programmed learning brought with it questions and answers ("prompts" and "responses"); yet there is no work on how to set such items in relation to the rest of the text. Modern science textbooks rely on a close interdependence of text and diagrams; yet again there is no research to guide the designer or typographer.

Errors of irrelevance and errors of omission are, of course, connected. The same mental set that predisposes researchers to choose problems that can be neatly handled in a laboratory also inhibits them from going outside their circle to see the problems that typographers face in practice. Moreover, empirical research is difficult, expensive and time-consuming. At any given time there are only a few people conducting experiments into legibility of print. If they misdirect their attention many years may elapse before more fruitful work can be started.

Even when he starts with a relevant problem, a researcher may still be misled by the " classical experimental paradigm." A researcher starts off with, say, the relation of line-length to legibility. He then tries to control all other variables. This is not only impossible (as we shall show) but actually *mistaken*, for any real situation will bring in dozens of other decisions, and those variables will, indeed, interact. Perhaps this very real interaction is what should be the focus of study.

The experiments on line-length make an interesting study. Most experimenters controlled for size of type (though exactly *how* size of type should best be measured is still not settled); and most controlled for leading (inter-line spacing). But until recently no notice was taken of justification. This practice (whereby the right hand edge of the print is kept aligned) alters the spacing between words, and does so in proportion to the length of line. The shorter the line, the more the inter-word spaces vary; with lines five or six words long some of the spacing effects can be quite bizarre. Very likely such spacing effects do bias line-length tests in favour of longer lines. Yet in all the classical line-length tests justification was not " noticed " and hence not controlled. There is now some evidence that ranged left (unjustified) settings are more legible for short lines and less able readers (Poulton and Gregory, 1970). This is small comfort, for without re-doing dozens of earlier experiments we cannot really be sure how to interpret older results for ranged-left settings.

We attribute such mistakes not to the incompetence of researchers, but to their mistaken use of the classical experimental paradigm drawn from the physical sciences. No one, in our opinion, can possibly predict all the variables that might interact with the one chosen for experimentation. And even if a comprehensive list of variables could (by some magic) be drawn up, the permutations would generate untold millions of experiments—far more than could ever be executed.

The few results that can be reliably applied to practical situations are further debilitated by technical questions about the way the experiments were conducted or, in some cases, by the way they have been reported in the journals. George Klare (personal communication) has reviewed over 40 experiments on the effect of changes in readability upon reader behaviour. He has come to the conclusion that many of the " no difference " results might stem from researchers using highly motivated subjects working under generous time limits (or no time limits). He points out that some experiments use students who get obvious rewards such as credits or money for acting as subjects; even more critical, however, are the subtle urges to increased effort that arise from an experimenter using his own students as subjects, with all the rewards (or punishments) that implies. When liberal time limits permit them to have an effect, strong motivation and superior intelligence are likely to compensate for differences that could well be significant in more usual reading/learning situations. Also, the practice of testing on small stretches of text biases results towards " no difference " because it reduces problems of attention, fatigue, and persistence that are often present in real life.

Lastly, we find experiments reported in journals without the actual examples being reproduced. Since only a few variables are explicitly catered for, the reader cannot be sure whether or not other features of the setting are likely to be relevant. As a general rule, we would say that no paper is valuable unless it presents an excerpt of the actual test materials as well as the methods and results. This one rule alone eliminates a good deal of the literature on typographic research.

### The modern consensus

Recently reviews of the literature have paid much more attention to the relation between practical problems and research findings. Spencer (1969) was the first designer to put on record his view of this research, Watts and Nisbet (1974) looked for clues useful to the design of children's books, and Burnhill and his colleagues (1975) looked explicitly at research relevant to the design of instructional materials. It seems that the problems outlined above are now common ground between researchers and practitioners, although they may be articulated in different ways.

We can, perhaps, speak of a *modern consensus* between researchers and typographers. Both groups have come to see the defects of the older literature, and would like to remedy those defects. All are agreed (though maybe only in a vague kind of way) that research should—indeed must—in future be of value to the practical designer and typographer. The issue is, how to achieve this? Below we put forward a simple three-part model which could act as a conceptual framework for improving typography by making research more relevant.

### Two preliminary readjustments

The first readjustment needed is for researchers to realise that when they deal with the world of the practical, their image of research must fit the new aims. In other words, the purpose of legibility research should be to improve the quality of practical decisions. We already have excellent models for research of this kind; operational research is one example; ergonomics is another. The objects of such research are not universal truths, but specific decisions in particular, practical situations.

A second much-needed readjustment is for researchers to recognise the importance of tacit know-how. Any casual acquaintance with typographers and designers will show that their skills are backed by tacit knowledge which is the product of experience rather than empirical tests or " book learning." Usually researchers dismiss such personal knowledge or even deny its existence simply because it has not been developed by orthodox experimental methods. But actually, as Polanyi (1962) has shown, all scientific knowledge (indeed all human knowledge) has its roots in the "tacit dimension."

So we should value the personal skills of typographers and designers, and take them as the starting point for more fruitful typographic research.

**Criticism**

We start with the act of criticism though since design is a cyclical process there is no single starting point. At any rate, criticism serves to make our point, for it is one of the ways tacit know-how gets externalised (placed in the public domain). For example, when a designer writes a report for a client he usually starts with a critique of existing solutions. Since few problems are really novel he can start by pointing out the strengths and weaknesses of previous designs, and thus set up the criteria for his own alternative solutions.

Criticism is, of course, one of the basic intellectual skills. It is a primary method in the humanities and fine arts; and plays a much underestimated role in the natural sciences. These extracts from the works of Karl Popper are most interesting:

> "Inter-subjective *testing* is merely a very important aspect of the more general idea of inter-subjective *criticism*, or in other words, of the idea of mutual rational control by critical discussion." (Popper 1968, p. 44n).
>
> "Our starting-point is common sense, and our great instrument for progress is criticism." (Popper 1972, p. 34).
>
> "We start, I say, with a problem, a difficulty. . . . At best, we have only a vague idea what our problem really consists of. How, then, can we produce an adequate solution? Obviously, we cannot. We must first get better acquainted with the problem. But how? My answer is very simple: by producing an inadequate solution, and by *criticizing* it."
> (Popper 1972, p. 260).

So we can see that the habit of criticism or intellectual discernment which designers habitually adopt is not only respectable, but actually essential for progress to be made.

**Alternatives**

There is usually more than one way, and sometimes many ways, to solve a practical problem. If we adopt Simon's (1959) model of "satisficing" then we see the designer's job as being to produce at least one good way to satisfy all the constraints in a particular situation. To do this he produces alternatives which can be criticised and tested. In the production of these alternatives we see again the tacit knowledge which classical researchers have tended to disdain.

Alternatives are, of course, the raw material of criticism. And criticism is a swift and economical way of rejecting obviously unsuitable options (though even an unsatisfactory solution may contain some ideas worth retaining). The close interrelation between alternatives and criticism can best be seen by studying Figures 1–3. These illustrations are taken from a student project based on Open University correspondence texts (Macdonald-Ross and Waller 1975); the original criticisms have been somewhat shortened.

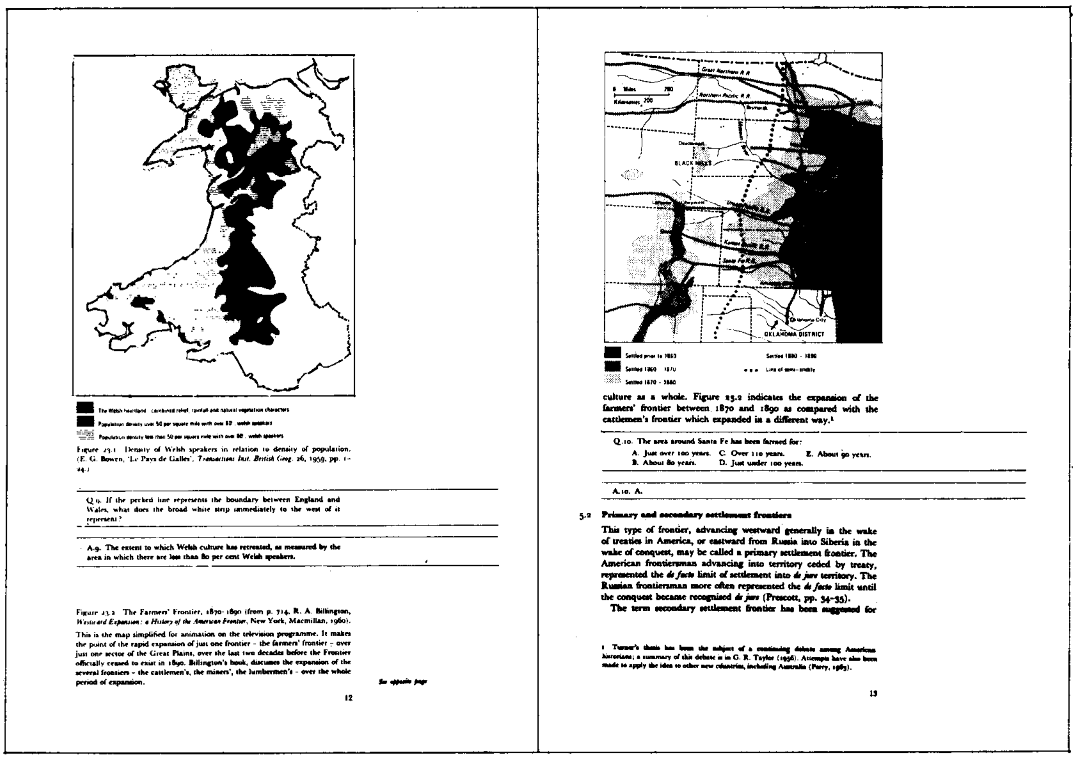
We feel these examples make some really important points; for example:

- the interplay of alternatives and criticism
- the interplay of variables in a real typographic problem

- the role of alternatives as a mind-freeing device: it is difficult to improve unless you can *see* other ways of solving the same problem.

**Testing**

There is a limit, of course, to the improvements that can be brought about without conducting empirical tests. Therefore, tests are essential to our model, but they are not the first resort of the practical man. As we have said, the one variable model is quite inappropriate. Testing should be done on a real-life version, with all the complexity that entails. This means that we are closer to formative evaluation or industrial production testing than to the classical paradigm.



The Welsh heartland – combined relief, rainfall and natural vegetation characters
Population density over 50 per square mile with over 80% welsh speakers
Population density less than 50 per square mile with over 80% welsh speakers

Figure 23.1 Density of Welsh speakers in relation to density of population. (E. G. Bowen, 'Le Pays de Galles', *Transactions Inst. British Geog.* 26, 1959, pp. 1–44.)

Q.9. If the perked line represents the boundary between England and Wales, what does the broad white strip immediately to the west of it represent?

**A.9. The extent to which Welsh culture has retreated, as measured by the area in which there are less than 80 per cent Welsh speakers.**

Figure 23.2 The Farmers' Frontier, 1870–1890 (from p. 714, R. A. Billington, *Westward Expansion: a History of the American Frontier*, New York, Macmillan, 1960).

This is the map simplified for animation on the television programme. It makes the point of the rapid expansion of just one frontier – the farmers' frontier – over just one sector of the Great Plains, over the last two decades before the Frontier officially ceased to exist in 1890. Billington's book, discusses the expansion of the several frontiers – the cattlemen's, the miners', the lumbermen's – over the whole period of expansion.

*See opposite page*

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culture as a whole. Figure 23.2 indicates the expansion of the farmers' frontier between 1870 and 1890 as compared with the cattlemen's frontier which expanded in a different way.[1]

Q.10. The area around Santa Fe has been farmed for:
A. Just over 100 years. C. Over 110 years. E. About 90 years.
B. About 80 years. D. Just under 100 years.

**A.10. A.**

5.2 **Primary and secondary settlement frontiers**

This type of frontier, advancing westward generally in the wake of treaties in America, or eastward from Russia into Siberia in the wake of conquest, may be called a primary settlement frontier. The American frontiersman advancing into territory ceded by treaty, represented the *de facto* limit of settlement into *de jure* territory. The Russian frontiersman more often represented the *de facto* limit until the conquest became recognized *de jure* (Prescott, pp. 34–35).

The term secondary settlement frontier has been suggested for

1 Turner's thesis has been the subject of a continuing debate among American historians; a summary of this debate is in G. R. Taylor (1956). Attempts have also been made to apply the idea to other new countries, including Australia (Perry, 1963).

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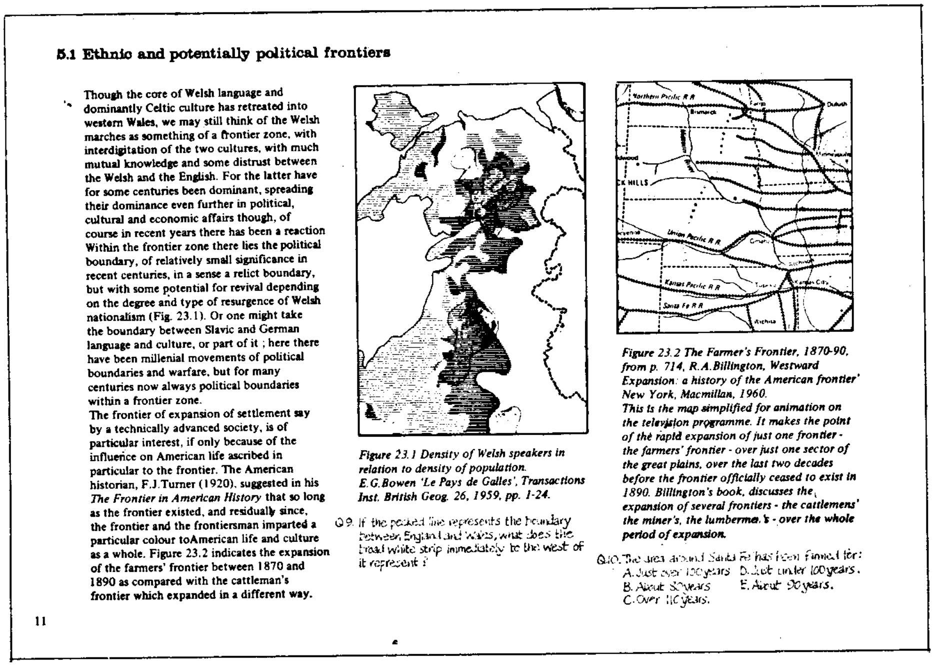
Figure 1a. Open University course D100 (Understanding Society), unit 23.

*Criticism*: Rigid adherence to the grid (framework for layout of text) has made the text difficult to follow. Notice especially:

- The text on page 13 is a continuation from page 11. When should the student answer Q9 and Q10 or look at Figure 23.1 and 23.2? The footnote further confuses the issue.
- Figure 23.2 (page 13, top) is separated from its caption (page 12, bottom), though there is plenty of room for the caption in the margins.
- The captions and questions look the same (light blue type smaller than the text). The answers are printed in black, bolder than the questions. Really, the answers not the questions should be made to retreat visually.



**5.1 Ethnic and potentially political frontiers**

Though the core of Welsh language and dominantly Celtic culture has retreated into western Wales, we may still think of the Welsh marches as something of a frontier zone, with interdigitation of the two cultures, with much mutual knowledge and some distrust between the Welsh and the English. For the latter have for some centuries been dominant, spreading their dominance even further in political, cultural and economic affairs though, of course in recent years there has been a reaction Within the frontier zone there lies the political boundary, of relatively small significance in recent centuries, in a sense a relict boundary, but with some potential for revival depending on the degree and type of resurgence of Welsh nationalism (Fig. 23.1). Or one might take the boundary between Slavic and German language and culture, or part of it ; here there have been millenial movements of political boundaries and warfare, but for many centuries now always political boundaries within a frontier zone.

The frontier of expansion of settlement say by a technically advanced society, is of particular interest, if only because of the influence on American life ascribed in particular to the frontier. The American historian, F.J.Turner (1920), suggested in his *The Frontier in American History* that so long as the frontier existed, and residually since, the frontier and the frontiersman imparted a particular colour toAmerican life and culture as a whole. Figure 23.2 indicates the expansion of the farmers' frontier between 1870 and 1890 as compared with the cattleman's frontier which expanded in a different way.

*Figure 23.1 Density of Welsh speakers in relation to density of population.*
*E.G.Bowen 'Le Pays de Galles', Transactions Inst. British Geog. 26, 1959, pp. 1-24.*

Q9. If the pecked line represents the boundary between England and Wales, what does the broad white strip immediately to the west of it represent ?

*Figure 23.2 The Farmer's Frontier, 1870-90, from p. 714, R.A.Billington, Westward Expansion: a history of the American frontier' New York, Macmillan, 1960.*
*This is the map simplified for animation on the television programme. It makes the point of the rapid expansion of just one frontier - the farmers' frontier - over just one sector of the great plains, over the last two decades before the frontier officially ceased to exist in 1890. Billington's book, discusses the expansion of several frontiers - the cattlemens' the miner's, the lumberman's - over the whole period of expansion.*

Q10. The area around Santa Fe has been farmed for:
A. Just over 100 years D. Just under 100 years.
B. About 50 years E. About 90 years.
C. Over 110 years.

11

Figure 1b. Design for D100, unit 23 by Margaret Perry.
*Alternative*: The students has solved the problem mainly by changing the grid. The three-column landscape (A4b) grid allows the text to run *without* interruption, and makes clear how diagram, legend and question are related.

It is not possible to give general rules about when and when not to test. Since tests are expensive and time-consuming they are a court of last resort. The expenditure must be balanced against the expected benefit. If failure is costly (as it may be with " functional literature ") then testing should be a regular part of the process of producing printed materials. There is also a case for testing where the printed materials carry the main teaching responsibility in an educational system (*e.g.* as at the Open University). Since we are dealing with specific decisions about particular problems each case must be looked at afresh. Yet it is strange how often tests of specifics lead to knowledge of wide application (Chapanis 1965).

In this model tests are not tests of individual variables. Instead, the researcher tests one coherent alternative against another. These alternatives are the refined product of the critical activity described earlier. In this way the tacit know-how of the designer or typographer is linked to the activity of experimental testing. The purpose of the testing is to make better decisions, not (directly) to discover universal truths.

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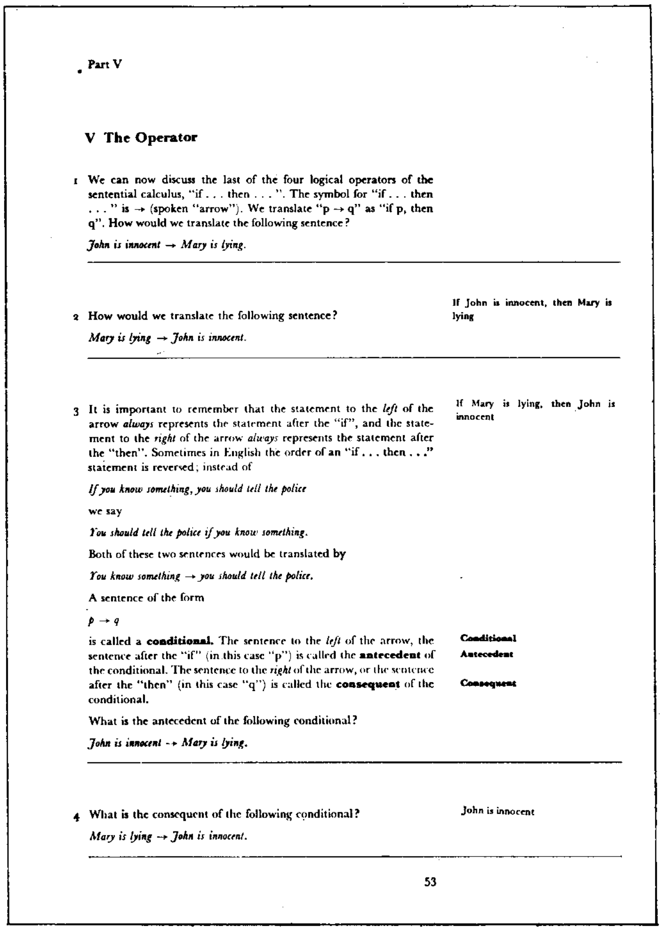

Part V

V The Operator

1 We can now discuss the last of the four logical operators of the sentential calculus, "if . . . then . . .". The symbol for "if . . . then . . ." is → (spoken "arrow"). We translate "p → q" as "if p, then q". How would we translate the following sentence?

*John is innocent → Mary is lying.*

If John is innocent, then Mary is lying

2 How would we translate the following sentence?

*Mary is lying → John is innocent.*

If Mary is lying, then John is innocent

3 It is important to remember that the statement to the *left* of the arrow *always* represents the statement after the "if", and the statement to the *right* of the arrow *always* represents the statement after the "then". Sometimes in English the order of an "if . . . then . . ." statement is reversed; instead of

*If you know something, you should tell the police*

we say

*You should tell the police if you know something.*

Both of these two sentences would be translated by

*You know something → you should tell the police.*

A sentence of the form

$p \to q$

is called a **conditional.** The sentence to the *left* of the arrow, the sentence after the "if" (in this case "p") is called the **antecedent** of the conditional. The sentence to the *right* of the arrow, or the sentence after the "then" (in this case "q") is called the **consequent** of the conditional.

What is the antecedent of the following conditional?

*John is innocent → Mary is lying.*

**Conditional**
**Antecedent**
**Consequent**

John is innocent

4 What is the consequent of the following conditional?

*Mary is lying → John is innocent.*

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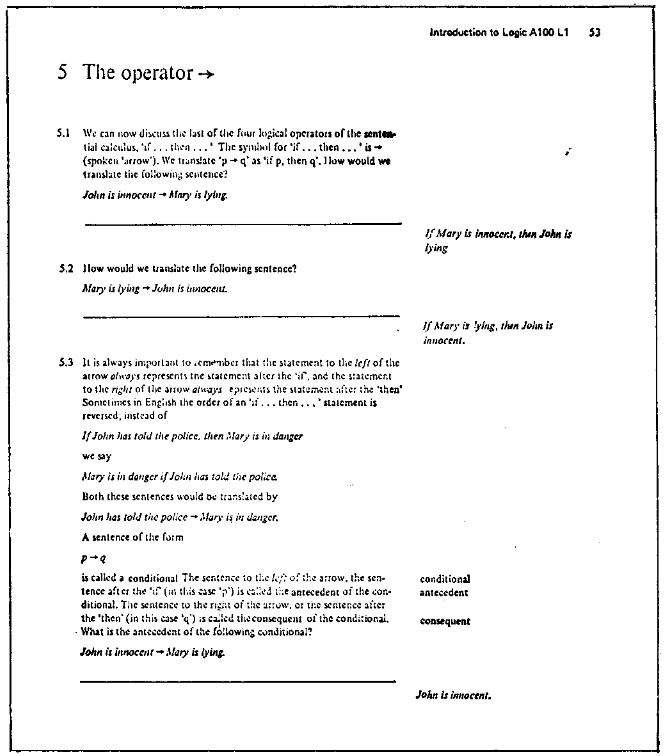
Figure 2a. Open University course A100 (Humanities), block L1—Introduction to Logic.

*Criticism*: Logic in A100 is of the few "traditional" programmed texts produced by the Open University. In such texts the designer must separate question from answer; he does this here by a horizontal rule. In doing so he falls into a trap: he makes the response seem part of the next frame.



Introduction to Logic A100 L1 53

5 The operator →

5.1 We can now discuss the last of the four logical operators of the sentential calculus, 'if . . . then . . .' The symbol for 'if . . . then . . .' is → (spoken 'arrow'). We translate 'p → q' as 'if p, then q'. How would we translate the following sentence?

*John is innocent → Mary is lying.*

*If Mary is innocent, then John is lying*

5.2 How would we translate the following sentence?

*Mary is lying → John is innocent.*

*If Mary is lying, then John is innocent.*

5.3 It is always important to remember that the statement to the *left* of the arrow *always* represents the statement after the 'if', and the statement to the *right* of the arrow *always* represents the statement after the 'then' Sometimes in English the order of an 'if . . . then . . .' statement is reversed; instead of

*If John has told the police, then Mary is in danger*

we say

*Mary is in danger if John has told the police.*

Both these sentences would be translated by

*John has told the police → Mary is in danger.*

A sentence of the form

$p \to q$

is called a conditional. The sentence to the *left* of the arrow, the sentence after the 'if' (in this case 'p') is called the antecedent of the conditional. The sentence to the right of the arrow, or the sentence after the 'then' (in this case 'q') is called the consequent of the conditional. What is the antecedent of the following conditional?

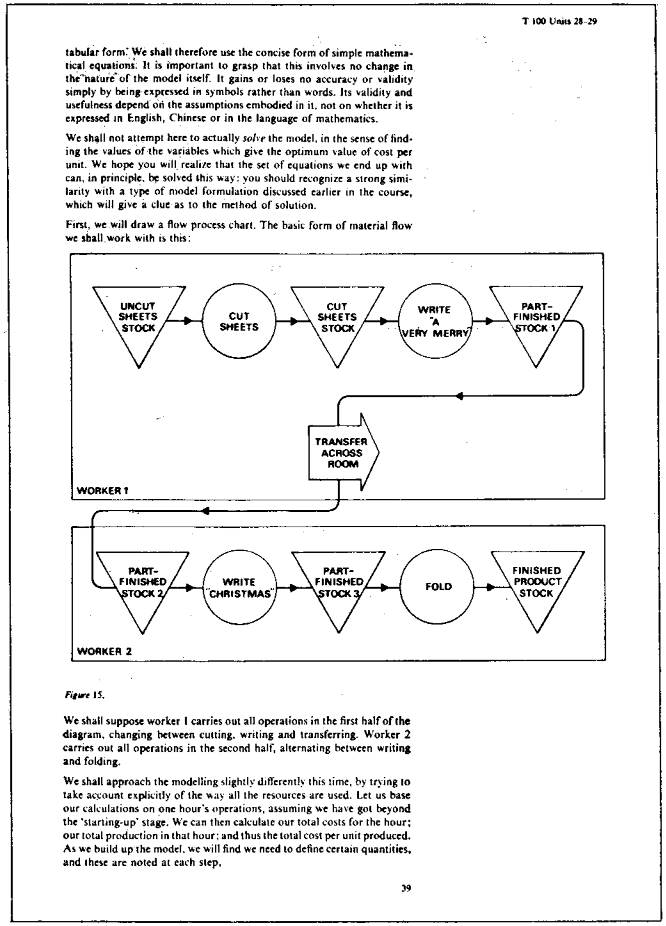
*John is innocent → Mary is lying.*

conditional
antecedent
consequent

*John is innocent.*

Figure 2b. Design for A100, block L1, by Paul Luna.

*Alternative*: This student explored six ways of placing the answer. We give here one of his best solutions. First, by stopping the rule short he avoids cutting off the answer completely (and incidentally lessens the 'chopped-up' feel of the page). Second, by placing the answer just under the rule he makes clear it is not part of the next frame. The eye travels naturally along the line, drops off and hits the answer (you could test this with an eye-movement camera). A natural visual progression is just what a designer aims for. Quite subtle differences in design can make a great deal of difference to the reader.


T 100 Units 28-29

tabular form. We shall therefore use the concise form of simple mathematical equations. It is important to grasp that this involves no change in the nature of the model itself. It gains or loses no accuracy or validity simply by being expressed in symbols rather than words. Its validity and usefulness depend on the assumptions embodied in it, not on whether it is expressed in English, Chinese or in the language of mathematics.

We shall not attempt here to actually *solve* the model, in the sense of finding the values of the variables which give the optimum value of cost per unit. We hope you will realize that the set of equations we end up with can, in principle, be solved this way: you should recognize a strong similarity with a type of model formulation discussed earlier in the course, which will give a clue as to the method of solution.

First, we will draw a flow process chart. The basic form of material flow we shall work with is this:



*Figure 15.*

We shall suppose worker 1 carries out all operations in the first half of the diagram, changing between cutting, writing and transferring. Worker 2 carries out all operations in the second half, alternating between writing and folding.

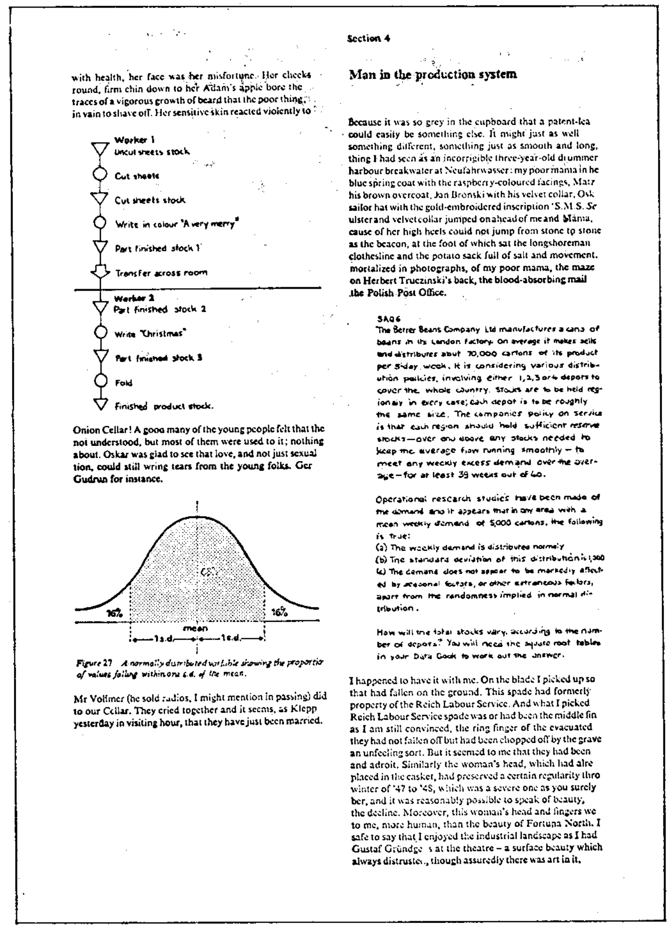
We shall approach the modelling slightly differently this time, by trying to take account explicitly of the way all the resources are used. Let us base our calculations on one hour's operations, assuming we have got beyond the 'starting-up' stage. We can then calculate our total costs for the hour; our total production in that hour; and thus the total cost per unit produced. As we build up the model, we will find we need to define certain quantities, and these are noted at each step.

39

Figure 3a. Open University course T100 (The Man-made world) Units 28–29.

*Criticism*: Consider the rather strange Figure 15. The problem here stems from two initial decisions:

- Choosing various awkwardly shaped symbols, and
- Fitting the text inside the symbols rather than outside. This makes the diagram rather big and clumsy, thus leading to the strange folded shape. This obscures the natural linear flow of the diagram. The choice of typeface is also unfortunate; Univers light condensed lower case would take much less space (so would handwriting!).


with health, her face was her misfortune. Her cheeks round, firm chin down to her Adam's apple bore the traces of a vigorous growth of beard that the poor thing in vain to shave off. Her sensitive skin reacted violently to



Onion Cellar! A good many of the young people felt that the not understood, but most of them were used to it; nothing about. Oskar was glad to see that love, and not just sexual tion, could still wring tears from the young folks. Ger Gudrun for instance.



*Figure 27 A normally distributed variable showing the proportion of values falling within one s.d. of the mean.*

Mr Vollmer (he sold radios, I might mention in passing) did to our Cellar. They cried together and it seems, as Klepp yesterday in visiting hour, that they have just been married.

Section 4

**Man in the production system**

Because it was so grey in the cupboard that a patent-lea could easily be something else. It might just as well something different, something just as smooth and long, thing I had seen as an incorrigible three-year-old drummer harbour breakwater at Neufahrwasser: my poor mama in he blue spring coat with the raspberry-coloured facings, Matz his brown overcoat, Jan Bronski with his velvet collar, Osk sailor hat with the gold-embroidered inscription 'S.M.S. *Se* ulster and velvet collar jumped on ahead of me and Mama, cause of her high heels could not jump from stone to stone as the beacon, at the foot of which sat the longshoreman clothesline and the potato sack full of salt and movement. mortalized in photographs, of my poor mama, the maze on Herbert Truczinski's back, the blood-absorbing mail the Polish Post Office.

SAQ 6
The Berrer Beans Company Ltd manufactures a cans of beans in its London factory. On average it makes sells and distributes about 70,000 cartons of its product per 5-day week. It is considering various distribution policies, involving either 1, 2, 3 or 4 depots to cover the whole country. Stocks are to be held regionally in every case; each depot is to be roughly the same size. The companies policy on service is that each region should hold sufficient reserve stocks—over and above any stocks needed to keep the average flow running smoothly—to meet any weekly excess demand over the average—for at least 39 weeks out of 40.

Operational research studies have been made of the demand and it appears that in any area with a mean weekly demand of 5,000 cartons, the following is true:
(a) The weekly demand is distributed normally
(b) The standard deviation of this distribution is 1,300
(c) The demand does not appear to be markedly affected by seasonal factors, or other extraneous factors, apart from the randomness implied in normal distribution.

How will the total stocks vary, according to the number of depots? You will need the square root tables in your Data Book to work out the answer.

I happened to have it with me. On the blade I picked up so that had fallen on the ground. This spade had formerly property of the Reich Labour Service. And what I picked Reich Labour Service spade was or had been the middle fin as I am still convinced, the ring finger of the evacuated they had not fallen off but had been chopped off by the grave an unfeeling sort. But it seemed to me that they had been and adroit. Similarly the woman's head, which had alre placed in the casket, had preserved a certain regularity thro winter of '47 to '48, which was a severe one as you surely ber, and it was reasonably possible to speak of beauty, the decline. Moreover, this woman's head and fingers we to me, more human, than the beauty of Fortuna North. I safe to say that I enjoyed the industrial landscape as I had Gustaf Gründge s at the theatre – a surface beauty which always distruste., though assuredly there was art in it.

Figure 3b. Design for T100, units 28–29 by Paul Kilvert-Jones.

*Alternative*: Quite a striking change occurs once the text is put outside the symbols. The new layout has these advantages:

- Takes less space.
- Emphasises the linear flow.
- Makes clear the boundary between the two workers.
- Solves the text/symbol problem. No longer does the text have to squeeze into awkward symbols.

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